

B.Tech 6th Semester Exam., 2014

NONCONVENTIONAL MANUFACTURING

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.
- (v) Assuming missing data, if any.

1. Answer/Choose the most appropriate option of the following (any seven) : $2 \times 7 = 14$

(a) Which of the following processes can be used to produce very small diameter holes?

- (i) Electric discharge machining
- (ii) Electrochemical machining
- (iii) Electron-beam machining
- (iv) Waterjet machining

(b) Which of the following methods uses a chemical known as etchant during machining?

- (i) Electrochemical machining
- (ii) Electric discharge machining
- (iii) Chemical machining
- (iv) Electron-beam machining

(c) Ultrasonic machining removes material from the workpiece by

~~(i) hammering action of abrasive particles~~

(ii) rubbing action between tool and workpiece

(iii) high-frequency sound waves

(iv) high-frequency eddy currents

(d) Vacuum is required in which of the following nonconventional machining methods?

(i) Laser-beam machining

(ii) Electron-beam machining

(iii) Electric discharge machining

(iv) Electrochemical machining

(e) Name the dielectric fluid used in EDM.

(f) Why is a magnetic lens used in electron-beam machining?

(g) Name three important maskant materials used in chemical machining.

(h) What is the typical application area of chemical machining?

(i) What is die sinking?

(j) For which type of material, ultrasonic machining is useful?

2. (a) Describe the steady state of hole penetration of LBM process. 10
- (b) A laser beam with a power intensity of 10^5 W/mm^2 falls on tungsten sheet. Find out the time required for the surface to reach the melting temperature. The given thermal properties of tungsten are melting temperature 3400°C , thermal conductivity $2.15 \text{ W/cm}^\circ\text{C}$, volume specific heat $2.71 \text{ J/cm}^3\text{-}^\circ\text{C}$. Assume that 10% of the beam is absorbed. 4
3. (a) Derive one single equation for computing interelectrode gap (IEG) during zero feed rate in ECM process. 10
- (b) In an ECM operation with the flat surfaces, a 10 V d.c. supply is used. The conductivity of the electrolyte is $0.2 \text{ ohm}^{-1} \text{ cm}^{-1}$ and a feed rate of 1 mm/min is used. The workpiece is of pure iron. Calculate the equilibrium gap. Consider the total over-voltage to be
- 1.5 V
- $A = 55.85 \text{ g}$
- $Z = 2$
- $\rho = 7.86 \text{ g/cm}^3$ 4

4. (a) Explain the mechanism of explosive welding process. 10
- (b) Discuss the plasma arc spraying process. 4
5. (a) Explain the working principle of EBM process. 10
- (b) During drilling holes in a steel work-piece by EBM an accelerating voltage of 150 kV is used. Determine the electron range. 4
6. (a) Find the condition for maximum power delivery to the discharging circuit in EDM. 10
- (b) EDM is used to machine a metallic sheet. Calculate surface finish value if $C = 15 \mu\text{F}$, $V_b = 130 \text{ V}$, $K_6 = 4.0$. Use the equation based on experimental results. 4
7. (a) What are the problems encountered in underwater welding process? 10
- (b) What are the characteristics of gas mixture forming? 4
8. (a) Explain the mechanism of metal removal of PAM. 10

- (b) Explain the following terms of EBM system : 2+2
- (i) Power supply
 - (ii) Vacuum system and machining chamber

9. (a) Discuss the effect of frequency and amplitude of vibration on material removal rate in USM. 10

- (b) A drill is required to be made in 5 mm thick tungsten carbide sheet. The slurry is made of 1 part of 320 grit (15 microradius) boron carbide mixed with $1\frac{1}{4}$ parts of water. The static stress is 1.4 kg/cm^2 and the amplitude of tool oscillation is 0.025 mm. The machine operates at 25000 circles/sec. The compression fracture strength of WC is 225 kg/mm^2 . Calculate the time required to perform drilling. Assume that only pulse out of 10 pulse are effective. 4

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